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A NEW CLASSIFICATION OF ANEMIAS

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Recent investigations into the physiology and histology of erythropoeisis and erythroclysis have been carried out by animal experimentation and tissue cultures of bone marrow. Clinical studies designed primarily to indicate satisfactory measures to be used in the treatment of the anemias have also shed much light on these hitherto inadequately explored fields. The results of these investigations must lead to a radical change in our concepts of the anemias, in our classification of them and in the tests we use in the laboratory for their diagnosis and prognosis.

Our old classification of "primary" and "secondary" anemias was admittedly conceived in ignorance. In its place we have substituted a classification based on the mean corpuscular volume and its deviation from the normal (macro-, micro-, and normocytic) and on the amount of hemoglobin contained in the red cell (hypo- and hyperchromic). But these are shifting sands on which to build our ideas, because anemia does not represent a stationary lesion of the bone marrow and the blood picture in any given case of treated or untreated anemia may change from a hypochromic microcytosis to a hyperchromic macrocytosis or vice versa. In other words, the blood pictures in anemias will be progressive and changing, just as tissue sections of an inflammatory lesion will be very different in different stages of its development. This picture may alter itself

spontaneously as in the remissions and crises of Addisonian and meniscocytic anemias, or it may be altered as a result of therapy designed to supply the missing building stones for erythropoeisis, or it may change due to excessive demands of an extraneous nature made on the bone marrow, such as infections and toxemias.

Anemia may be defined as a diminution of the amount of hemoglobin below the normal arbitrary value of 100%. This hemoglobin is dependent on the oxygen tension of the inspired air and the need for keeping it constant in the internal environment of the organism. The size and number of the erythrocytes is always the optimum for the utilization of this hemoglobin (1). The saturation of the red cell with hemoglobin can never exceed a certain concentration, although large red cells may contain absolutely more hemoglobin than normocytes and microcytes. Relative hypochromia, or unsaturation of the red cells with hemoglobin, does exist.

Boycott (2) has suggested the term "erythron" for the red cell and its precursors and has calculated from the size of the red marrow cavities and the volume of the circulating blood, that, disregarding the plasma, the erythron represents an organ the size of the liver. In intrauterine life there are islands of erythropoeisis in the liver and spleen as well as in the bone marrow.

Doan, Cunningham and Sabin (3) have been able to make the first satisfactory observations on erythropoeisis. By injecting pigeons with typhoid vaccine they were able to clear all the blood cells from the marrow and then study the regeneration of the cells in sections. They found that the leucocytes are manufactured by the reticulo-endothelial cells outside the capillary sinusoids, while the whole of the erythron is intravascular. The endothelial cell of the intrasinusoidal capillary divides by mitosis and gives rise to a megaloblast in the lumen. These observers think the megaloblast then divides into two erythroblasts, but this mitosis is uncertain. At any rate, the next stage in the maturation is the smaller normoblast, which in turn loses its nucleus. The stroma begins to take on more hemoglobin and to disperse it more evenly, but some of the reticular structure persists for a time and the cell is known as a reticulocyte. This reticulocyte soon loses the reticulum, takes on its full concentration of iron-bearing pigment and an erythrocyte is the result.

During this process of maturation the capillary has been distended but the young red cells are not thrown into the circulation because they are sticky and adhere to the endothelium. When the cell matures it loses this stickiness and is sucked into the circulation by the pressure of the blood. Under stress, the endothelium

of the sinus may produce megaloblasts, or strain may result in premature opening of the intrasinusoidal capillaries. Either of these two processes would mean nucleated red cells in the blood smears we examine.

The life of the erythrocyte has been estimated at thirty days (4). At the end of this time it is either fragmented or hemolyzed and the resulting iron and bilirubin are stored for re-use in the manufacture of new hemoglobin. Rous, Doan and Sabin (10) conclude that normally these worn-out erythrocytes are not hemolyzed but are "literally threshed to bits." Poikilocytes and microcytes are partially fragmented red cells. The reticulo-endothelial system is active in erythroclysis and in the salvaging of the iron and bilirubin.

If erythroclysis is proceeding at an abnormal rate, some of the bilirubin will "dam up" in the blood serum, resulting in a high icteric index, and some will be excreted by the kidneys as urobilin in the urine. The normal excess of bilirubin is excreted as stercobilin in the feces and in exaggerated hemoclysis the concentration of this compound in the stool rises tremendously. The iron will collect in excess in the spleen and liver where it is usually stored, and an attempt will be made by the kidneys to excrete it, so that iron deposits will be seen in the uriniferous tubules.

Anemias associated with exaggerated hemoclysis have been termed "hemolytic anemias." For years the role of destroying the red cells has been ascribed to the spleen. And when hyperbilirubinemia and urobilinuria are associated with anemia, the cause has been attributed to an over-activity of this organ. Hemolytic anemias of unexplained etiology have thus been conveniently labelled "splenic anemias" of which there are two well defined clinical types —Banti's anemia or the splenic anemia of adults—and Von Jaksch's anemia or the splenic anemia of children. Such a classification, however, will not stand, for Banti's anemia has been observed in infants under two years of age, and the anemia originally described by Von Jaksch is probably the disease re-named by Cooley as "Erythroblastosis."

There is no evidence, either clinical or experimental, which should lead to our laying these anemias on the spleen's door-step. The organ is enlarged it is true, but there is splenomegaly associated with eighty per cent of all chronic anemias. The spleen, containing as it does a large part of the reticulo-endothelial apparatus in man, plays a part in initiating the conversion of hemoglobin into bilirubin and iron. Moreover the red cells contained in the ampullae of the spleen are less resistant to the action of hypotonic saline

than those in the general circulation. However, it must be remembered that the spleen stores large numbers of red cells "like a bank stores money" and pays them out as need arises. It may be that these fragile cells are the old cells stored in the spleen until they can be fragmented by the reticulo-endothelial cells located there and elsewhere.

When there is fibrosis of the spleen, as in Banti's, or when the reticulo-endothelial cells in the spleen are congenitally diseased so that they are unable to maintain their physiological function adequately, as in Gaucher's disease, anemia is only one of many signs and symptoms.

Now let us turn to a study of the factors which may interfere with the normal maturation of the erythrocyte. To begin with, certain basic substances are required out of which to manufacture erythrocytes, e.g., obviously iron and globin (probably a histidine-like substance) for making hemoglobin and certain proteins and lipoids for the stroma and cell membrane (if such exists). Just what building substance is required to initiate the maturation divisions of the reticulo-endothelial cell and the erythroblast is not known. It is probably of protein nature and if it is missing an aplastic anemia results (Fig. 1). If Vitamine B and some other fraction of liver extract are deficient, the maturation process stops

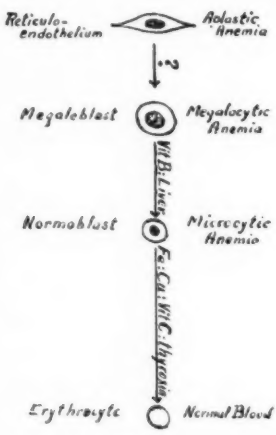


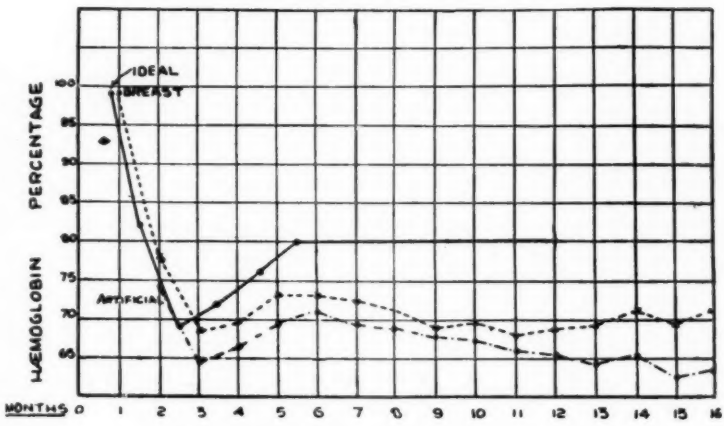
Fig. 1

with the megaloblast and a megalocytic or macrocytic anemia results. When these substances are added to the diet, the megaloblast will mature into a normoblast. But if iron, copper, Vitamine C,

and probably also traces of cobalt and manganese are withheld, then the normoblast cannot mature further and a microcytic anemia results.

Anemias due to deficiencies in the diet are best exemplified by the simple anemia of milk-fed infants. Mackay (5) has shown that this anemia is due to an insufficiency of iron and that if it is supplied the hemoglobin values of the infants will rise to normal levels (Fig. 2).

HÆMOGLOBIN CURVES IN INFANCY (MACKAY).



.———. Ideal curve: infants with adequate iron intake.
×- - -× Curve in breast-fed infants.
o—o—o Curve in artificially-fed infants.

Fig. 2

Anemias due to dietary deficiencies are very properly termed "deficiency anemias." A metabolic deficiency, for example, hypothyroidism, may also interfere with the maturation of the red cell, as for example in the anemia of cretinism. Witts has shown that the normoblast cannot mature without thyroxine.

There is another large group of deficiency anemias which is due not so much to dietary or metabolic deficiencies, as to a failure of the physiology of the individual, which prevents proper absorption of these necessary building substances or a proper utilization of them. The most classic example of anemia of this type is pernicious anemia. In these subjects there is lacking not only the "extrinsic factor" of Castle, (which is present in concentrated amounts

in liver) but an "intrinsic factor." This intrinsic factor is a rennin-like enzyme elaborated by the normal gastric mucosa. In normal individuals the intrinsic factor splits the proteins in red meat into the extrinsic factor which is then carried to the liver and stored. In subjects with pernicious anemia, the gastric mucosa fails to make the intrinsic factor and the extrinsic factor must be supplied "ready-made" from the liver of some other animal.

Now it is well known that there are certain pernicious anemia families, the members of which all show achlohydria, but only a few of whom develop anemia. Their dietaries may be regarded as roughly similar and the absence of free HCl in the stomach contents would be evidence that the gastric mucosa was not normal. Why, then, are some anemic, while others are able to maintain their red cells and hemoglobin at normal levels? And animals on which artificial gastrectomy has been performed, rarely or only after an interval of years, develop anemia. It is possible that under certain circumstances, the intestine may take over the elaboration of the intrinsic factor, or it may be that a third factor, the hematinic principle, is absent in some individuals. Castle thinks this hematinic principle governs the metabolism of iron and bilirubin, and controls the maturation of the red cells just as insulin controls the storage and release of sugar.

Next let us examine the series of changes which take place in the erythron just after birth. In intrauterine life there is a relative anoxemia, and the red cells are increased in size and numbers to carry an extra load of hemoglobin that will insure sufficient oxygen supply to the tissues at this low tension. At birth this condition is altered, and there is a plethora of red cells and hemoglobin. There are two ways in which the infant gets rid of this excess of erythrocytes—his extra-medullary islands of erythropoeisis in liver and spleen close up, and he manufactures his red cells at a slower rate than formerly, and his reticulo-endothelial cells destroy the erythrocytes more actively and rapidly than ever afterwards. Hence, he will have all the evidences of increased erythroclysis: bilirubinemia, urobilinuria, etc. In certain infants this physiological icterus will progress and severe and even fatal jaundice will ensue (icterus gravis neonatorum). Or it may be that to get rid of the red cells, the child will bleed spontaneously from skin and mucous membranes (hemorrhagic disease of the newborn). When the blood cells are destroyed too rapidly, the bone marrow becomes hyperplastic and pours large numbers of immature and nucleated red cells into the circulation (erythroblastosis of Cooley).

Calls for new red cells will always be made when there is an acute loss of blood, or too rapid destruction of blood in the body.

As a first line of defense, the marrow will pour out all the normal erythrocytes available. Then will come basic-stained red cells and reticulocytes. Next will come normoblasts and in the infant the extra-medullary islands of erythropoeisis in spleen and liver will open. Finally megaloblasts will appear in the circulating blood. In the adult the demands for new red cells are met in much the same way, and although the bone marrow may be able to compensate in this way for some deficiencies in the numbers of the cells, such immature cells are physiologically incapable of carrying on efficient oxygenation and the young red cells in the circulation have been compared to "children attempting the work of men" (*7*).

A normal bone marrow is able to compensate for loss of blood very quickly but if the demands for more hemoglobin continue, it may fail or become aplastic. When this happens, no megaloblasts, nor normoblasts, nor even reticulocytes will be found in the blood smears. If the marrow becomes hyperplastic to the extent that normoblasts only are matured before they are put into the circulation, a microcytic anemia will result, and if there is only time and material to mature the red cells to the megalocytic stage, a macrocytic anemia results.

Unfortunately, our knowledge of factors governing the physiological balance between erythropoeisis and erythroclysis is very scanty. But we do know some of the reasons why this balance is disturbed. For example, we know that certain toxins (as from lead and benzol, and from parasites like the dibothricephalus latus) destroy the red cells faster than they can be replaced or paralyze the marrow so that it cannot manufacture them at the usual rate. We know also that certain children are born with a congenitally diseased erythron, and that their red cells are fragmented or hemolyzed more easily than those of normal people. But until we can count the number of red cells entering and leaving the circulation every twenty-four hours, hematology can never be an exact science (*4*). But even now the laboratory worker has several valuable indices by which to measure erythroclysis or erythropoeisis:

1. The reticulocyte count. The presence of reticulocytes in the circulating blood in above the normal numbers is our only satisfactory indication that blood regeneration is going on. Their presence means that the bone marrow is not aplastic, nor profoundly hypoplastic.

2. The "fragility" test. This is an unfortunate test and an unfortunate term. We will do well to remember, what physiologists have been telling us for generations, that the resistance of erythrocytes to hypotonic solutions depends on their age, young red

cells being far more resistant than older ones, and their curves showing a much wider range. A curve beginning at 0.48% NaCl, and being complete at 0.2% NaCl, simply means that there is a large number of immature erythrocytes in the circulation. If we keep this fact in mind, we can understand the shift in some of these curves noted in individual patients at different stages of anemia. Broun states that mechanically the megaloblast is a very fragile cell. But reticulocytes and normoblasts are far more resistant than mature erythrocytes. In our work on sickle cell anemia we found that the resistance to hypotonic saline solutions altered very materially, and that the shift to the right or to the left in the curves and the lengthening of the base line more or less closely paralleled the appearance or disappearance of normoblasts and reticulocytes, as the exacerbations and remissions of the hemolytic crises occurred. Aub, Reznikoff and Smith, found similar wide ranges in their work on red cells in lead poisoning (9).

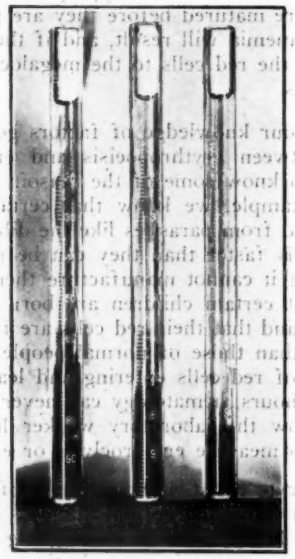


Fig. 3

Volume indices in three cases of anemia. All three patients had red cell counts of 2,700,000 per cu. mm. Tube on left (pernicious anemia) has volume index of 1.2; tube in middle (posthemorrhagic anemia) has volume index of 1.0; tube on right (Gaucher's splenomegaly) has volume index of 0.6.

The literature is crowded with references to "increases" and "decreases" in fragility and it is difficult to gather whether the authors refer to shifts in the curves, or widening of their ranges.

3. Our indices of exaggerated hemoclysis are even more tenuous, since the presence of bilirubin in the blood and urobilin in the urine, are influenced also by the state of health of the liver and kidneys, and even "latent" jaundice may be of hepatogenous origin. However, the occurrence of bilirubinemia and urobilinuria or hemoglobinuria, may be taken in the absence of clinical evidence to the contrary, as indications of increased blood destruction. The qualitative Van den Bergh and the icteric index are therefore two fixed stars by which we set our compass when we set sail to make a diagnosis of hemolytic anemia. Similarly, the quantitative estimation of stercobilin in the feces is a very valuable criterion in the diagnosis of increased erythroclysis.

4. Measurement of the size of the red cells can be carried out in two ways and tells us whether we are dealing with a normocytic or a macrocytic phase of marrow hyperplasia. We may use either the more elaborate Price-Jones index, which gives us the mean corpuscular diameter and variation of the individual red cells from it, or we may use the more convenient hematocrit, which gives us only the average of red cell size, but gives this in three diameters.

One point to be borne in mind in the study of anemias is the close embryological and anatomical relationship between the erythron and the myelocytic series of cells. Irritants which act on the intra-sinusoidal reticulo-endothelial cells, will act on the extra-sinusoidal cells as well, and young leucocytes are found in the smears in many cases of anemia. This is particularly true in the anemias of children, where the erythron and the whole blood-making apparatus are very much more labile than in the adult.

With these facts in mind, I have developed the classification of anemias which appears on the following pages. The ideas contained therein are not new, but since the rational classification of any group of diseases must rest on etiology, I have attempted to analyze the causes of anemias, and to use this as a basis for the table. Since our knowledge of the causes of many anemias is still obscure, the classification will be incomplete, or perhaps inaccurate, but it can be revised or discarded as time indicates.

SUMMARY. Anemia—is a deficiency in the hemoglobin below a normal arbitrary standard of 100%. Theoretically all early anemias are normocytic and normochromic. If they progress they become microcytic and hypochromic, provided there is no metabolic or dietary deficiency, since the normal bone marrow replaces the

stroma of the lost erythrocytes more rapidly than it fills them with hemoglobin. If the anemia progresses further a macrocytic and hyperchromic anemia may result and finally progression leads to failure of the marrow, aplastic anemia and death. These processes may be rapid or slow, and if the marrow does not fail, they may be arrested at any time, i.e., the balance between erythroclysis and erythropoeisis can be restored. With the restoration of this balance, the blood picture will undergo these processes in reverse order.

If erythroclysis exceeds erythropoeisis, then we get a high icteric index, urobilin or even hemoglobin in the urine, increase of stercobilin in the feces, and deposits of excess iron in spleen, liver and kidneys. If the bone marrow is forming new red cells to try to restore the balance, we will get an increase in reticulocytes, a decrease in "fragility" (increase in resistance to hypotonic solutions) and even normoblasts and megaloblasts.

I. MECHANICAL ANEMIAS. Due to:

1. Direct destruction of red cells as in

   A. Acute and chronic loss of blood: hemorrhage, bleeding ulcers: purpura, etc.

   B. Hemolytic agents: (Often associated with toxemias. Cf III below).

      (1) Hemolytic bacteria as Streptococcus Beta, etc.

      (2) Hemolytic agent in paroxysmal hemoglobinuria (possibly luetic).

      (3) Hemolysins in incompatible blood.

      (4) Hemolytic action of parasites, e.g., malaria.

2. Tying up the hemoglobin into more stable compounds than oxyhemoglobin:

   A. CO poisoning where carboxyhemoglobin is formed.

   B. Chlorate poisoning where methemoglobin is formed.

3. Enchroachment on the red marrow:

   A. Osteosclerosis ("marble bones").

   B. Leukemia (where leucopoeitic tissue crowds out the erythropoeitic).

   C. Tumors in the red marrow cavity.

II. CONSTITUTIONAL ANEMIAS. Due to:

1. Congenital dystrophy of the erythron.

   A. Familial or acquired hemolytic icterus.

   B. Meniscocytic ("sickle-cell") anemia.

2. ? dyscrasia of spleen or reticulo-endothelial system.

   A. Banti's disease.

   B. The lipoid histiocytoses (etiology = ? faulty metabolism of fats).

      (1) Gaucher's disease.

      (2) Niemann-Pick's disease.

3. Exaggeration of the normal physiological increase in erythroclysis which occurs at birth:

   A. Hemorrhagic disease of the newborn.

   B. Icterus Gravis Neonatorum.

   C. Erythroblastosis of Cooley (probably same as Von Jaksch's anemia, anemia pseudoleukemia infantum, etc.).

III. TOXIC ANEMIAS. Due to irritant and depressant action of poisons on the bone marrow and body fluids.

1. Action of known toxins:

   A. Chemical—As, Benzol, Pb, T.N.T., Shellac, etc., etc.

   B. Bacterial—particularly Treponema pallidum and organisms infecting the renal pelvis.

   C. Parasitic (also mechanical effect, see I above): Hookworm, Dibothricephalus latus, etc., etc.

   D. Vegetable—mushroom poisoning.

2. Action of unknown toxins:

   A. Azotemic (anemia of nephritis).

   B. Toxemias associated with diseases of the liver: esp. cirrhosis.

   C. Toxemia of malignancy.

   D. Hemolytic anemia of pregnancy (?).

IV. DEFICIENCY ANEMIAS. Due to:

1. Dietary deficiencies:

   A. Simple anemia of infants. (Iron deficiency).
   B. Anemia of scurvy. (Vitamine C deficiency).
   C. Tropical anemia (Vitamine B deficiency).
   D. Sprue (Liver extract deficiency).
   E. Anemia of pellagra (Protein and vitamine deficiency ?).

2. Metabolic deficiency:

   Anemia of cretins and myxodema (deficiency of thyroxine).

3. Physiological and/or dietary deficiencies:

   A. Pernicious anemia.

   B. Chlorosis (lack of iron plus ? lack of ovarian hormone).

   C. Anemias associated with diseases of gastro-intestinal tract:

      (1) Stenosis of small intestine.
      (2) Simple achlohydric anemia.
      (3) Coeliac disease.
      (4) Fatty diarrhea.
      (5) ? Chronic pancreatitis.

REFERENCES

(1) Fahraeus, R. Suspension Stability of Blood, Phys. Rev. IX, p. 241, 1929.
(2) Boycott, Proc. Roy. Soc. Med., XXII, 15, 1929.
(3) Doan, Cunningham and Sabin, Contributions to Embryology, Carnegie Institute, Washington, XVI, p. 163, 1929.
(4) Witts, L. J., Pathology and Treatment of Anemia (Three Goulstonian Lectures), Lancet, 222, pp. 495-500, 549-600, 653-657, 1932.
(5) Mackay, H. M. M., Anemia in Infancy, Arch. Dis. Child., 3, 117, 1928 and Ibid. 8, 221, 1933.
(6) Castle, W. B., Heath, C. W., Strauss, M. B., Relationship of Achylia Gastrica to Pernicious Anemia, etc., Am. J. Med. Sci., 182, 741, 1931.
(7) Graham, G. S., Pathology of Anemias of Early Infancy, J. Ala. Med. Ass., 4, 1934.
(8) Graham, G. S., and McCarty, S. H., Sickle Cell (Meniscocytic) Anemia, S. M. J., 23, 598, 1930.
(9) Aub, J. C., Reznikoff, P., and Smith, D. E., Lead Studies, Pt. I, J. Exp. Med., XI, 151, 1924.
(10) Doan, C. A., Sabin, F. R., Normal and Pathological Fragmentation of Red Blood Cells, J. Exp. Med., 43, 839, 1926.

THE NATURE AND THERAPEUTIC APPLICATIONS OF BACTERIOPHAGE*

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GENERAL PROPERTIES

1. *Bacteriophagy* or transmissible lysis of bacteria was discovered independently by Twort in 1915 and d'Herelle in 1917.
2. *Bacteriophages* attack only living bacteria and cause partial or complete lysis of organisms during the early phases of growth. The term means "devourer of bacteria."
3. They are filterable through Berkefeld and other bacteria-retaining filters.
4. They are highly active *in vitro* and one part of bacteriophage filtrate may dissolve as much as one billion parts of susceptible culture.
5. They can be propagated indefinitely by transference of a small amount of one lysed culture to another but they cannot be cultivated on bacteria-free media nor in cultures of old or dead bacteria.
6. Bacteriophages are generally highly specific for species or races of bacteria and have little or no effect on unrelated organisms.
7. They appear to be particulate bodies and their size has been estimated at 10 to 50 millimicrons.
8. They are slightly more resistant to heat and chemical agents than non-spore bearing bacteria and withstand aging for long periods.
9. They do not attack body cells or produce infection but possess antigenic properties and may engender the production of antibacteriophages.

NATURE OF BACTERIOPHAGE

1. d'Herelle has always contended that bacteriophage is a living submicroscopic virus, parasitic on susceptible bacteria.
2. Many investigators, however, believe it is an inanimate substance, perhaps an enzyme or an activator of an endocellular hydrolytic bacterial enzyme, having its origin in the bacterial cell which it lyses and, being capable of lysing other cells, increasing in amount in the process.

* Abstract of address delivered before the Staff of Temple University Hospital on January 11, 1935.

3. Others believe that it is an inanimate substance which affects physiologic or hereditary processes of the sensitive bacteria in such a way that early death and autolysis of the culture is brought about.
4. Since bacteriophage may induce rapid and extensive variation in bacterial cultures aside from its lytic activity some investigators believe that it may stimulate bacteria to pass into a submicroscopic filterable stage. According to this theory bacteriophage is a filterable stage in the complex life cycle of a bacterium.

ORIGIN AND FATE OF BACTERIOPHAGE

1. d'Herelle believes that there is a single original source, possibly the intestines of man and animals (because of the abundance of bacteriophage in sewage) and that all specific phages have been derived from this by a process of adaptation to particular bacterial species.
2. Hadley, however, believes that sewage and pancreatic extracts contain a substance which causes bacteria to produce phage from the culture itself.
3. Good evidence of the spontaneous origin of bacteriophage in previously unaffected cultures is lacking but this may occur.
4. Sewage filtrates usually contain mixtures of bacteriophage.
5. Bacteriophage is not absorbed from the intestinal tract of normal animals.
6. When injected it is rapidly eliminated in the urine and feces. Only traces can be detected in the liver, blood, etc., after 24 hours. Considerable accumulates in the spleen. It also tends to collect in inflammatory exudates where it is probably carried by infecting organisms.

PREPARATION AND COMPOSITION OF BACTERIOPHAGE FILTRATES

1. The bacteria in young cultures in a fluid medium are lysed or completely dissolved by phage and used as such or after passage through a Berkefeld filter for therapeutic purposes.
2. The filtrate, however, contains substances other than bacteriophage which may play a part in therapeutic effects and especially if injected intravenously or subcutaneously. These are (1) the constituents of the broth as meat extractives and muscle proteins, etc., (2) substances from the bacteria themselves as proteins, metabolic products, toxins, etc., (3) possibly the antivirus of Besredka.

3. Consequently when injected the effects may be due not only to bacteriophage but to: (1) Protein shock as a result of the proteoses, peptones and bacterial proteins; (2) the production of antibodies to the bacterial products (requiring 4 to 5 days) and (3) possibly to the effect of antivirus (Besredka).

BACTERIOPHAGE THERAPY IN EXPERIMENTAL INFECTIONS

1. In the test tube the lytic activity of bacteriophage is markedly inhibited by whole blood, undiluted serum and bile. Pus, urine, ascites fluid and cerebrospinal fluid are slightly inhibitory.
2. For these reasons the results of bacteriophage therapy of experimental septicemias produced by staphylococci and streptococci have been usually negative probably because of the inhibitory action of the blood.
3. Better results, however, have been observed in the treatment of experimental infections produced by bacilli of the typhoid-colon-dysentery group.
4. Furthermore the treatment of experimentally produced infections of the body cavities as the bladder, subarachnoid space, pleural cavities, peritoneum, the intestine and abscess cavities have yielded more encouraging results.

BACTERIOPHAGE THERAPY IN HUMAN INFECTIONS

1. d'Herelle has explained most failures as being due to the use of bacteriophage which was not sufficiently active or "virulent" for the infecting organisms.
2. For this reason in vitro lysis of the infecting organism by the bacteriophage should always be demonstrated before the agent is used in treatment.
3. Many of the commercial bacteriophages are lacking in lytic activity and whenever possible should be first tested for lysis in the laboratory before use.
4. The many reports of good results from the use of bacteriophage in human infections makes it likely that this therapy is of value in the treatment of some infections but much of the work has not been adequately controlled with broth filtrates alone, the use of culture filtrates without 'phage, etc.
5. Many of the conflicting results reported may be due to the use of phages of varying lytic activity as well as to variations in dosage and method of application.
6. Furthermore the good therapeutic effects may have been due not only to bacteriophage itself but likewise to other constituents in the broth filtrates.

BACTERIOPHAGE IN LOCAL STAPHYLOCOCCIC INFECTIONS

1. Probably best results in bacteriophage therapy have been obtained in the treatment of *furuncles, carbuncles, wound infecfections, osteomyelitis* and various *pyodermias* (sycosis vulgaris and acne vulgaris) caused by the staphylococci.
2. Accurate bacteriological examination should be made and a phage actively lytic *in vitro* employed.
3. For local application bacteriophage prepared in broth may be used while that prepared in asparagin medium (MacNeal) is preferred for injection.
4. Wet dressings and irrigations with phage are advised after drainage has been established and as much pus removed as possible. The phage should be brought into the best possible contact with the infected tissues at least twice a day. Antiseptics should not be used at the same time.
5. Injections of 1 to 5 c.c. may be made at different points about the base of a furuncle or carbuncle preferably before incision. Less extensive incisions may be required under this treatment.
6. Albee believes that in about 94 per cent of cases of acute and chronic osteomyelitis a specific bacteriophage develops spontaneously in the Orr closed method of treatment.
7. Intraspinal injections of 10 to 40 c.c. every 12 hours after thorough drainag may be helpful in the treatment of *staphylococcus meningitis.*
8. Local applications in *chronic sinusitis* by means of wet packs or the displacement method of Proetz appear to have been sometimes helpful. Daily applications are preferred. In antrum infections phage may be injected into the cavities.
9. In *bed sores* due to mixed staphylococcus and B. coli infections local applications every 6 to 12 hours are sometimes very helpful.

BACTERIOPHAGE IN STAPHYLOCOCCIC SEPTICEMIA

1. The general mortality of this septicemia is 40 to 50 per cent.
2. Encouraging results have been reported in treatment with phage despite the fact that the blood and other factors are known to inhibit lytic activity, render regeneration of phage almost negligible and that a concentration sufficient for lysis in vivo is difficult to attain.
3. Diagnosis by blood culture is required; only actively lytic phage in asparagin medium should be used.

4. Drainage of local lesions, blood transfusions and supportive treatment should be given.

5. Bacteriophage may be administered *intravenously* after the following plan of MacNeal: for the first dose 0.5 c.c. or 5 c.c. of a 1:10 dilution in sterile saline. After 40 minutes 1 c.c. and after another 40 minutes 2 c.c. This is continued doubling the dose each time until a dose of 8 or 10 c.c. is reached or until the patient develops a shock reaction. Thereafter 1 to 4 c.c. daily for several weeks, even though blood cultures are negative, to prevent metastatic abscesses. Shock reactions are desirable suggesting that protein shock may be more important than bacteriophage.

6. In osteomyelitis, abscess of the kidney, multiple early abscesses of the lungs and other deep seated infections intravenous injections may be given after this manner.

BACTERIOPHAGE IN STREPTOCOCCIC INFECTIONS

1. Actively lytic streptococcus bacteriophages are much more difficult to prepare and the results of treatment have not been nearly as good as in staphylococcus infections.

2. In *cellulitis, carbuncles, infected wounds,* etc., injections may be made around the lesions along with wet applications and irrigations as in the treatment of local staphylococcus infections.

3. In *septicemia* the phage should be given intravenously in the manner described in addition to the best possible local drainage, blood transfusions, administration of concentrated anti-streptococcus serum and supportive measures.

4. Early administration of these measures in particularly important.

5. It appears to offer some hope in the treatment of ulcerative endocarditis if actively lytic phage is available.

6. The production of shock reactions is desirable and my impression is that therapeutic effects are largely if not entirely due to these non specific protein reactions.

7. Intracarotid (every 24 hours) and intraspinal injections (every 4 to 6 hours) may be tried in the treatment of the highly mortal *meningitis* while the best possible drainage is given the primary infections.

BACTERIOPHAGE IN B. COLI AND OTHER INFECTIONS OF THE URINARY TRACT

1. The results have not been as good as in staphylococcus infections. In the majority of cases *B. coli* is present along with streptococci and other organisms. Accurate bacteriological diagnosis is required.
2. Many strains of *B. coli* are resistant to lysis and resistant forms of bacteria seem to present real problems in bacteriophage treatment as well as the inhibitory action of colloidal substances in the urine.
3. The urine should be rendered *alkaline* (pH of 7.0) by the administration of sodium citrate before phage is employed.
4. Probably best results have been obtained with daily subcutaneous injections of 2 c.c. with instillations of the bladder and pelvis at frequent intervals; large amounts up to 50 c.c. may be required.
5. Intravenous injections are indicated when the lymph spaces or renal cortex are involved. Apparently successful bacteriophage therapy proceeds from above downward.
6. Apparently useless in pyelitis and cystitis secondary to some other disease as in obstruction, calculus, hydronephrosis and renal tuberculosis.
7. In abscess of the kidney intravenous injections are required.
8. In *B. coli* pyelitis of children daily subcutaneous injections of 1 to 2 c.c. have been reported as successful.
9. In *prostatitis* and *seminovesiculitis* due to staphylococci subcutaneous injections may be tried.
10. Recurrences after phage treatment are very frequent.
11. There is no convincing evidence that a *gonococcus* bacteriophage has been discovered. Subcutaneous injections of "gonophage" (Pelouze and Schofield) may be helpful; local instillations increase the discharge.

BACTERIOPHAGE IN ENTERIC DISEASES AND BUBONIC PLAGUE

1. In typhoid fever and paratyphoid fevers, bacillary dysentery and cholera oral administration has been generally employed.

2. Some phages, however, are apparently destroyed by hydrochloric acid in the stomach and inhibited by substances in the intestinal canal. Bile is strongly inhibitive.

3. d'Herelle believes recovery is due to bacteriophage in the intestinal contents but patients have recovered with none in the feces and others have died despite its presence.

4. *Typhoid* bacteriophage apparently has no striking therapeutic effects by oral administration. Subcutaneous and intravenous injections may be temporarily helpful by producing protein shock reactions.

5. In *Asiatic cholera* treated with the oral administration of phage the mortality has been practically unchanged. d'Herelle claims to have stopped epidemics by adding cholera bacteriophage to drinking water.

6. In *bacillary dysentery* the results have been conflicting and for the most part inconclusive despite the enthusiastic predictions of d'Herelle.

7. In *bubonic plague* d'Herelle has reported excellent results from injection of phage into the buboes but these results have not been confirmed.

BACTERIOPHAGE IN SUPPURATIVE PNEUMONITIS

1. The author has shown that intrabronchial injections of bacteriophage in rabbits and dogs are extremely well borne.

2. The treatment of intractable *chronic bronchitis,* early *bronchiectasis* and lung abscess with mixtures of actively lytic staphylococcus and streptococcus bacteriophage offers a safe, reasonable and hopeful plan of treatment.

3. Bronchoscopic drainage and lavage for the removal of as much mucopurulent secretions as possible are required before the instillation of 10 to 20 c.c. of phage.

4. Frequent applications are indicated. Daily instillations by a passive method are advised followed by additional instillations at longer intervals.

5. Bacteriophage for the pulmonary spirochetes has not yet been discovered or produced.

6. These local applications may be supplemented by daily subcutaneous injections of 2 c.c. In pulmonary abscess intravenous injections may be given (2 c.c.) followed by subcutaneous injections.

THE ANTIVIRUS OF BESREDKA

1. This is usually prepared by cultivating organisms in broth for 10 days and passing through a Berkefeld filter.
2. The filtrate is said to inhibit the growth of the homologous organisms and hence is called "antivirus."
3. In the author's experience the filtrates are largely bactericidal because of the presence of bacterial metabolites.
4. The antivirus, however, may contain some bacteriophage.
5. Besredka has advised local applications or oral administration of antivirus on the basis that cells are desensitized or made unreceptive to infection by a process of local immunization.
6. Since this may be possible the local applications of bacteriophage may owe part of their efficacy to a similar local immunization by the bacterial products they contain in addition to any direct lytic effects.
7. Local immunization by the application of antivirus to the skin, abscesses, bronchial mucosa, sinuses, etc., as well as by oral administration in the prevention and treatment of enteric infections, however, appears to be unproven and not well founded on facts; rather the therapeutic results appears to depend more on general immunization consequent to absorption.

PIONEERS IN MEDICAL TECHNOLOGY*

Antoine Laurent Lavoisier

(1743-94)

Lavoisier (pronounced Lav-wah-zee-air), the founder of the antiphlogistic or modern chemistry, was born in Paris, France. He devoted himself to scientific studies, particularly chemistry. In 1769 he accepted the office of farmer-general, and in 1786 he was made an academician. In 1791 he was appointed a commissioner of the treasury. He rendered great service in the application of chemistry to agriculture.

He established the quantitative relations of chemical reactions and produced the first classic proofs of the fundamental law of the "conservation of matter." Lavoisier's most important contribution to the advancement of science was his accurate and brilliant explanation of combustion. His book "Elementary Chemistry" wrought a chemical revolution. Although Priestly isolated oxygen, he explained the facts of respiration in an inverted order, being misled. Lavoisier, however, first accurately described oxygen (1775) and discovered (1777) the true nature of the interchange of gases in the lungs. Lavoisier's services to science could not save him from the popular rage of the farmers against taxes during the Reign of Terror, and he died by the guillotine.

**This is the third of a series of brief historical sketches with reproductions of some of the prominent figures who have had an important influence on medical technology.*

Editorials

THE 1935 ANNUAL MEETING

The annual session of the American Society of Clinical Laboratory Technicians, held in Atlantic City, June 10, 11 and 12, was outstanding in that there were 180 members in attendance, representing 24 states. The scientific exhibitors and essayists included Dr. Donald Van Slyke, of The Rockefeller Foundation; Dr. Russell L. Haden, of Cleveland; Dr. Warren T. Vaughan, of Richmond, Va.; Dr. Walter Martin, of Norfolk, Va.; Dr. Roy R. Kracke, of Emory University; Dr. Robert Kilduffe, Atlantic City Hospital, Atlantic City, N. J., and Dr. Maurice Brodie, of Bellevue Hospital, New York City.

The meeting opened Monday in the Robert's Room of Chalfonte Hotel, which is adjacent to and connected with Haddon Hall. The morning was devoted to the executive session and a feature talk by Dr. Robert A. Kilduffe on "History of Hospitals."

On Monday afternoon and throughout Tuesday, the scientific meetings attracted the interest of the technicians, who gleaned some valuable information during this time from the many excellent papers dealing with general problems of their profession which had been especially selected by the Program Committee for this purpose.

On Tuesday evening, the Entertainment Committee sponsored a boat ride on the ocean, which was followed by a sea food dinner for which Atlantic City is famous.

On Wednesday morning, the members again assembled in executive session to complete the new business and to elect officers. The election was spirited, which indicated that much thought was given to the nomination of each candidate. The results of the ballot can be found under "News and Announcements" in this issue.

The feature of the afternoon was a trip to the Atlantic City Hospital, where Dr. Robert A. Kilduffe gave a demonstration on serology.

The closing feature was a banquet Wednesday evening in the Gold Room of the Chalfonte Hotel. One hundred members and guests attended.

Dr. Phillip Hillkowitz, chairman of the board of registry of the American Society of Clinical Pathologists, acted as toastmaster. Dr. J. S. McLester, president of the American Medical Association, was presented and extended his felicitations to the Society. Among the speakers of the evening were Dr. Malcolm T. MacEachern, acting director of the American College of Surgeons; Dr. Roy R. Kracke, of Emory University, president of the American Society of Clinical Pathologists; Dr. Maurice Brodie of the Bellevue Hospital and Medical School, and Dr. S. A. Goldberg, Presbyterian Hospital, Newark, New Jersey.

Acting for the committee on awards, in the absence of Dr. Walter E. King, of Detroit, Dr. Kano Ikeda, of St. Paul, Minnesota, presented the silver medal to Sister Mary Joan, R.S.M. of Mercy Hospital, Baltimore, Maryland, for her survey paper and exhibit on laboratory procedures throughout the United States.

The second award (bronze medal) went to Paul C. Brown, of Beth Israel Hospital, Newark, New Jersey, for his paper on blood phosphatase. The third award (bronze medal) went to Miss Myra Effinger, of Altoona, Pa., for her paper on problems of the technician working alone in a small laboratory. The fourth award (bronze medal) went to Miss Margaret Kirby, Medical Center, New Jersey, for her paper on bacillary dysentery.

Honorable mention was made of the exhibit of Miss Phyllis Stanley, New Jersey, on the preparation of the pathological museum in a hospital.

Congratulations were extended to Miss Sarah McCarty of Birmingham, the second president of the organization for her successful leadership.

The thanks and appreciation of the American Society of Clinical Laboratory Technicians are tendered to Dr. Kilduffe, the Program Committee, the Committee on Local Arrangements, and all those who gave their time and effort to make our third annual meeting a success.

THE LABORATORY TECHNICIAN AS A FIGHTER OF DISEASE

Like the physician and the nurse, the technician in the clinical laboratory considers his or her calling not just a means of making a living but as an enlistment in a sacred cause. With all the arguments for the economic urge impelling the choice of a certain vocation, the aspirants for laboratory work are inspired by idealistic

motives that come from the heart and swayed by the deeper feelings. How often do we meet laboratory workers formerly engaged in what they considered a prosaic or repetitious activity and who were attracted into this endeavor by the lure of doing something for humanity! Behind every blood count, with the cutting of every section, there is a heart interest story, involving the fate of a human being. The technician may play a subsidiary role in the drama but often it is a very important part in shaping the outcome of the particular event. Hence, the stress and emphasis on intellectual honesty and technical excellence.

The technician is behind the scene, away from the limelight, but his role in the wings is an effective aid to the principals in the cast. Due to the modesty and unobtrusiveness of his function, the movie and stage have not as yet grasped the opportunity of portraying the technician as a silent fighter in the battle against disease be it in the hospital, in the laboratory of the clinical pathologist, the doctor's office, or in the public health bureau.

In the complex set up of modern medicine and with the rapid extension of laboratory methods in the diagnosis of disease, the enrollment of technical workers has become indispensable to an effective economy of time, brains, and resources. As the years go on, there will be more and more recognition of the value of the Laboratory Technician in the health program.

P. H.

News and Announcements

BOARD OF REGISTRY

OF A. S. C. P.

The Board of Registry held its annual meeting during the Convention of the American Society of Clinical Pathologists, June 7-9, 1935, and passed a number of resolutions which will be of great interest to registrants, both actual and prospective.

1. All graduates from a college or university with the title of B.S. or A.B., who have majored in chemistry or biology and who have received twelve months' laboratory training in an approved school and successfully passed the registry examination will automatically be granted the designation of medical technologist. The same will hold true of present certificate holders of the title L.T. whose records show similar collegiate credits and degree. This momentous step was taken in order to encourage the higher educational qualifications of future technicians. It will likewise obviate the difficulties encountered by the Board in making their annual awards and eliminate unnecessary heartaches on the part of aspiring applicants for the M.T. designation. It is the hope of the Board of Registry that when its ultimate aim is attained of a college education for every technician, all the registrants will be M.T.'s and therefore only one category with a title more befitting this important profession.

2. Certificates will be re-issued and will bear the imprint in conspicuous and differently colored type of the year of renewal.

3. Renewals will be reviewed by the Counsellor of the district in which the registrant resides and issued on his approval.

4. The Code of Ethics of certificate holders will be amplified to enjoin them from carrying out laboratory procedures for physicians who are not clinical pathologists but who undertake to do laboratory work for other practitioners of medicine. In other words, it is permissible for a registrant to be employed by a clinician provided the laboratory work done is for his own patients. The same holds true of groups or clinics who may want to exploit their technicians with outside work.

Dr. Philip Hillkowitz of Denver and Dr. Kano Ikeda of St. Paul were re-elected as members of the Board of Registry for another three-year term thus insuring a continuity of the aims and policies of the Board as previously maintained. Hearty endorsement was given the Board by the membership of the A. S. C. P.

A splendid exhibit of the work of the Registry was shown during the convention of the A. S. C. P. and subsequently at the scientific section of the A. M. A. meeting in Atlantic City.

The unprecedented number of 464 applicants took the last semi-annual examination held in April of this year in various cities of the United States and Canada, 108 examiners conducted the tests. The results will be published in a subsequent issue, also the written questions propounded.

NATIONAL

Proceedings of the Atlantic City Session

The abstracted minutes of the third annual convention of the American Society of Clinical Laboratory Technicians held in Atlantic City, June 10-12, 1935, follow:

The third annual meeting of the American Society of Clinical Laboratory Technicians was called to order Monday, June 10, 1935, by the president, Sarah M. McCarty, following an invocation by the Reverend Warren W. Way, D.D., of St. James Episcopal Church, Atlantic City, New Jersey.

In the absence of the Secretary, Vivian Herrick, the minutes of the last meeting were read by Sister Alma le Duc, St. Thomas Hospital, Akron, Ohio, and were approved as read.

Dr. Robert A. Kilduffe, Atlantic City, New Jersey, read a paper entitled, "Highlights in the History of Hospitals," in which he traced the growth of the hospital movement and the care of the sick from pagan times to the Christian era up to the present time.

The president announced the appointment of the following committees:

1. Nominating Committee:

   Sister Alma, Akron, Ohio
   Harry Macko, Cleveland, Ohio
   Madie Murphy, Birmingham, Alabama
   Edna Wilson, Atlantic City, New Jersey
   Sister M. Claude, Baltimore, Maryland

2. Resolutions Committee:
Clara New, Birmingham, Alabama
John Conlin, Detroit, Michigan
Christine Seguin, Chicago, Illinois

Mrs. Scott, Registrar of the Registry of Technicians of the A. S. C. P., who was in attendance at the opening session, was asked to rise and be introduced to the assembly.

The following gifts to the Society were announced by the president:

1. Music for the banquet donated by the Philadelphia District Society of Clinical Laboratory Technicians.

2. A silver medal bearing the seal of the Society by Miss Frieda Ward of New Jersey.

3. A gavel from the Birmingham Society of Clinical Laboratory Technicians.

The president then delivered her message to the assembled members.

John H. Conlin read the report of the Executive committee, publication and membership. It was moved that this report be accepted. The motion was seconded and carried.

The report of the program committee submitted by Sister Joan was read into the minutes.

Christine Seguin read the treasurer's report. The chairman of the Executive committee moved that this report be accepted; the motion was seconded and carried.

It was moved that Charles Brombel, Ph.D., and Anna R. Scott be made honorary members. The motion was seconded; the vote was unanimous.

There was no unfinished business.

New Business

(This portion of the executive session was devoted mainly to the adoption of plans for the working organization of the new administrative office and the duties of the administrative secretary.)

These incorporations will be included in the revised constitution which will be sent, in the near future, to all members of the Society in good standing.

The executive session reconvened at 4:40 p. m. with the president presiding and Miss Murphy of Alabama acting as secretary.

A motion was made that the section pertaining to dues, which was subject to the discretion of the Executive Committee be substituted and fixed at $4.00 per year. This motion was seconded and carried.

It was moved that the fiscal year run from July 1 to June 30 instead of from June 1 to May 31. The motion was seconded and carried.

It was moved that a Board of Counsellors be appointed to serve three years. They shall represent such districts as may be determined. It shall be the duty of the counsellors to act in the interest of the organization in their respective communities. This section is to replace the old section where the appointment was for one year. The motion was seconded and carried.

It was moved that Article 2, Section 2 of the by-laws pertaining to membership be stricken out as membership work could be carried on by the administrative office. The motion was seconded and carried.

It was moved that the words "commercial exhibits" be removed from Article 4, Section 4, as this work could be carried on by the administrative secretary. The motion was seconded and carried.

It was moved that the Annual Convention be held in the same city and during the same week as the A. M. A. meeting, and that the members shall be notified 90 days prior as to the time and place of meeting. The motion was seconded and carried.

June 12, 1935, 10:12 A. M. The report of the Resolutions Committee was read by Clara New, Chairman. It was moved that the report be adopted. The motion was seconded and carried.

John H. Conlin gave his report on insignias at 11:45 A. M., June 12th. A pocket insignia bearing the words, registered laboratory technician, on an outside band of blue with L.T. in the center on white or Registered Medical Technologist on the band of blue with M.T. in the center was presented. A motion for its adoption was made, seconded and carried.

It was moved that the adoption of a laboratory coat be made universal for technicians and be worn whenever and wherever possible. The motion was seconded and carried.

At quarter to one, June 12, 1935, a final executive session was called to order by the president.

Samuel Feder was appointed sergeant-at-arms. F. De Vaux and J. Naamee were appointed tellers.

It was stated that the conditions of the officers for office were controlled by their affiliation and that each one slated was qualified in every way.

A motion was made at this time that the nominations be closed. The results of the ballots were as follows:

Robert Jenkins, President
Sister M. Joan of Arc Wilson, Vice-President
John H. Conlin, Administrative Secretary
Cecil Gowen and Luella Gifford, Executive Committee
Phyllis Stanley, Advisory Board

The president read the rules regarding officers and the assembly substantiated the working up of candidates from a lower office to a higher and more responsible office.

It was moved that the third annual executive session adjourn. The motion was seconded and carried, Wednesday, June 12, 1935, 2:45 P. M.

Otto Folin. In the Jan. 11, 1935 number of Science, Dr. Philip A. Shaffer has a beautiful eulogy of the life of Dr. Folin which every technician should read. He follows his life from his birth in Sweden in 1867, his coming to America when fifteen years of age, his graduation from the University of Minnesota with a B.S. in 1892, how he got his Ph.D. from the University of Chicago six years later h,is studies abroad and in America in biochemistry, all through his long and useful life. His research in biochemistry and the methods he developed for testing the various elements of the blood and other body fluids merit him the title of "Father of Biochemistry." Some of the analytic methods he devised twenty or thirty years ago have never been improved upon.

Dr. Folin died Oct. 25, 1934. He is survived by his widow and a son living in Detroit, and by a daughter, Teresa Folin, a physician now at the Children's Hospital of the University of Chicago.

Photographs (size 8 by 10) of the assembled members or of the exhibits, appearing in this issue of the Bulletin can be ordered from the administrative office.

STATE

Indiana

Mrs. Jounin of Indianapolis wrote that the technicians there are working on plans for an Indiana Society of Clinical Laboratory Technicians. Indiana has more than fifty registered clinical laboratory technicians.

Minnesota

Miss Marion S. Polasky, L.T., of Duluth, Minnesota, wrote that the technicians there are forming a Minnesota Society of Clinical Laboratory Technicians. There are more than a hundred registered technicians in Minnesota so the society should be a success. We are anxious to hear details of their first meetings.

Ohio

Miss Angela Swoboda, L.T., secretary of the Ohio Society of Clinical Laboratory Technicians, made a tour of the large cities in the south of the state for the purpose of interesting the technicians in the State Society, as well as to make arrangements for the State Convention which will be held in the Fall.

District No. 1 held its May meeting at Mercy Hospital, Canton. Miss Cena Rickey, L.T., presented a paper on Blood Cholesterol. A moving picture showing a technician performing the actual test accompanied Miss Rickey's explanations. A medical moving picture on Allergy was then shown and explained by Dr. Max Shawaker, pathologist, of Dover and Canton. Dr. Shawaker then took the group to the laboratories and demonstrated some of his latest "gadgets." There were 19 technicians and three pathologists at the meeting, as well as a few nurses and internes.

District No. 4 held its April meeting at the Institute of Pathology in Cleveland. Dr. Roman Hanzal, bio-chemist at the Institute, was the guest-speaker. He gave a most instructive lecture on blood chemistry. Miss Mary Schauffer, vocational counsellor, spoke about a course in Medical Technology which is being arranged at Western Reserve University. Tentative plans call for three and a half years at the University and six months in the Institue of Pathology or a recognized hospital laboratory. The Akron University in District No. 1 is working on similar plans which it hopes to have ready by the Fall term. The goal is a Bachelor of Science Degree in Medical Technology.

Oklahoma

Miss Ida Lucille Brown, L.T., of Oklahoma City, is taking steps to form an Oklahoma Society of Clinical Laboratory Technicians. As there are more than a score of registered clinical laboratory technicians in Oklahoma City alone the prospects look encouraging.

South Dakota

The South Dakota Society of Medical Technicians was organized in Huron, South Dakota, and their initial meeting was held May 20th and 21st, 1935.

During their two days' session many papers of interest were presented by pathologists as well as technicians. Twenty technicians attended the meeting which was deemed highly successful.

On Monday evening, May 20th, a banquet was held and the guest speaker was Dr. J. C. Ohlmacher, Dean of Medicine and Professor of Pathology and Bacteriology of the University of South Dakota.

The following officers were elected:

President—Mrs. Bernice Iverson, Vermillion, S. D.
Vice-Pres.—Sister M. Leonard Fitzgerald, Sioux Falls, S. D.
Sec.-Treas.—Helen Olson, Huron, S. D.

Board of Counsellors:

Mr. Samuel Crabb, Rapid City, S. D.
Sister M. Zita Regan, Mitchell, S. D.
Sister M. Hermina Licken, Yankton, S. D.
Vivian Kilpatrick, Sioux Falls, S. D.

The next place of meeting is to be the University of South Dakota at Vermillion, S. D., in October, 1936.

Virginia

The Tidewater Society of Clinical Laboratory Technicians, organized in the Fall of 1934, adopted its constitution on November 14th. Thirteen technicians from Norfolk, Newport News, and Portsmouth, Virginia, signed as charter members. The Society has had twelve meetings since organizing, six of which were planned meetings. These included addresses by prominent physicians of the community—internists, surgeons and pathologists, as well as papers by the technicians themselves. Laboratory Pioneers, Blood Grouping, the Schilling Differential, and Complement Fixation were among the subjects. At the annual business meeting in May Miss Luella Gifford, M.T., was elected president for 1935-1936.

State and local or district organizations are invited to send in any news of their meetings, elections, or other items of information. Address Sister Alma Le Duc, St. Thomas Hospital, Akron, Ohio. These will be printed in each issue as far as space permits.

VIEWS FROM THE ATLANTIC CITY MEETING

(1) Some of the members in attendance.
(2-3) Sections of the Scientific and Educational Exhibit.
(4) Assembly Room (front) showing Dr. Vaughan's charts on allergy.
(5) Assembly Room (rear) showing graphic forms from questionnaire.

Book Reviews

Maximow's and Bloom's TEXTBOOK OF HISTOLOGY.

The illustrations in this textbook permit more accurate visualization of microscopic structures than any the reviewer has ever encountered. These are marvelously executed, many on a three-dimensional plan and a great number are in color. Some are schematic but there are a number of photomicrographs and the majority of the illustrations are drawings with wonderful cellular detail. If you really want to know what a block of liver, or lung or intestinal mucosa looks like, turn the pages of this book.

Although the authors of this volume are anatomists, explanations of the physiology of the different tissues and cell types, make up a large part of the text. This is a particularly interesting approach to the study of histology for those of us who can never understand how a thing is made until we find out how it works.

Maximow's own ideas of the histogenisis of the blood and some of the connective tissues are rather unorthodox. They are carefully expounded here and while the student may not agree with the text of these chapters, the argument is certainly effectively and convincingly presented. No histological methods are included.

In spite of the fact that the new edition contains 170 pages less than the 1930 volume, very little of the "meat" has been removed. The less important facts have been set in smaller print. The book has been made more inexpensive and more convenient to handle by this condensation. The greater part of the revision falls in the chapters on the Nervous Tissue and in the discussion of the female genital system. These are timely changes. A bibliography adequate for most of us, has been added at the end of each chapter.

Although the text was written primarily for medical students it will prove instructive and helpful for all laboratory workers interested in histological technic and its applications. W. B. Saunders Co., Publishers, 1934. Cloth, 662 pages. Price $7.00.

Pepper's and Farley's PRACTICAL HEMATOLOGICAL DIAGNOSIS.

This well planned volume should be studied carefully by all technicians attempting hematology.

The material is presented in three parts. The first deals with

the components of the blood, the significance of their study and the significance of the results obtained. Part II deals with the hematological diagnosis of diseases of the hemopoeitic system and Part III lists the hematological findings in diseases not of the blood.

The more recent changes in hematological technic and the newer procedures developed as a result of the broadening of this field are outlined adequately and carefully. The reader is spared the controversies usually met in discussions of histogenisis of the blood; significance of abnormal cells, etc., by the simple expedient of inserting the references to original work on the subject. These references are placed at the foot of each page. The authors spare and make few suggested changes in terminology.

The sections dealing with hematocrit determination, sedimentation rate, identification of abnormal leucocytes and Schilling's modification of Arneth's classification of the granular leucocytes; are especially recommended for careful perusal.

The biggest drawback to the book is the fact that there are only three plates. These are in color and very good. The descriptions of the various cell types are excellent and many tables and charts help in the lucid presentation of the facts.

The authors are evidently familiar with the problems of a general hospital laboratory and it is this familiarity which makes the book valuable from a technician's viewpoint. The methods recommended are the simplest compatible with accuracy. Price $6.00.

BOOKS RECEIVED

Books received are acknowledged under this heading. Selections will be made for more extensive review as space permits.

CLINICAL LABORATORY METHODS, by R. B. H. Gradwohl, M.D., Director of Gradwohl Laboratories, Director of Laboratories, St. Louis County Hospital, Chief of Staff and Pathologist to Christian Hospital, Lieutenant Commander, Medical Corps Fleet, U. S. Naval Reserve. C. V. Mosby Co., Publishers, 1935. Cloth, 1028 pages, Price $8.50.

CLINICAL LABORATORY MANUAL for Nurses and Technicians, by Sister Alma, Chief Laboratory Technician, St. Thomas Hospital, Akron, Ohio. C. V. Mosby Co., Publishers, 1932. Cloth, 159 pages, Price $1.75.

A TEXTBOOK OF BIOCHEMISTRY, edited by Benjamin Harrow, Ph.D., Associate Professor of Chemistry, the City College, College of the City of New York and Carl P. Sherwin, M.D., Sc.D., Dr.P.H., LL.D., member of the Staff of St. Vincent's Hospital and French Hospital, New York City. W. B. Saunders, Publishers, 1935. Cloth, 797 pages, Price $6.00.

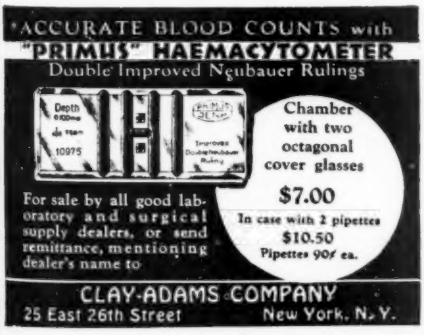
A TEXT-BOOK OF BACTERIOLOGY, by William Ford, M.D., Professor of Bacteriology, School of Hygiene and Public Health, Lecturer on Hygiene, School of Medicine, John Hopkins University, Member of State Department of Health, of Maryland. W. B. Saunders, Publishers, 1927. Cloth, 1069 pages, Price $8.50.

BIOCHEMISTRY IN INTERNAL MEDICINE, by Max Trumper, Ph.D., Clinical Chemist and Toxicologist, and Abraham Cantarow, M.D., Instructor in Medicine, Jefferson Medical College, Assistant Attending Physician, Philadelphia General Hospital, in charge of Laboratory of Biochemistry, Jefferson Hospital. W. B. Saunders Co. Publishers, 1932. Cloth, 454 pages, Price $5.50.

CLINICAL DIAGNOSIS BY LABORATORY METHODS, a working Manual of Clinical Pathology, by James Campbell Todd, Ph.B., M.D., late Professor of Clinical Pathology, University of Colorado, School of Medicine and Arthur Hawley Sanford, A.M., M.D., Professor of Clinical Pathology, University of Minnesota (The Mayo Foundation); Head of Section on Clinical Laboratories, Mayo Clinic. W. B. Saunders Co., Publishers, Seventh Edition, 1934. Cloth, 765 pages, Price $6.00.

A TEXT-BOOK OF GENERAL BACTERIOLOGY, by Edwin O. Jordan, Ph.D., Professor of Bacteriology in the University of Chicago and in Rush Medical School, Tenth Edition, Entirely Reset. W. B. Saunders Co., Publishers. Cloth, 819 pages, Price $5.00.

BIOCLINICAL LABORATORY METHODS, by Clarence Austin Morrow, Ph.D., late Assistant Professor of Agricultural Biochemistry, University of Minnesota and revised and rewritten by William Martin Sandstrom, Ph.D., Assistant Professor of Agricultural Biochemistry, University of Minnesota. John Wiley & Sons, Inc., Publishers, 1935. Cloth, 319 pages, Price $3.75.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PAST DISCOVERIES

Pasteur discovered bacillus of malignant edema in 1877.

Neisser discovered gonococcus in 1879.

Hansen and Neisser discovered lepra bacillus in 1879.

Abstracts

AMOEBIC DYSENTERY, SOME ADVANCES IN THE SCIENCES DURING 1934, Science News, Science, Vol. 81, No. 2088, Jan. 4, 1935.

Among other very interesting findings the following was reported: "The cysts which transmit amoebic dysentery can be filtered out of water by the usual filtration methods used to purify water supplies, Dr. Bertha Kaplan Spector, U. S. Public Health Service, and John R. Bayliss and Oscar Guillins, chemists of the Chicago Department of Public Works, found in experiments at the Chicago Experimental Filtration Plant."

STUDIES ON STAPHYLOCOCCI, W. L. Holman, M.D., C.M., Amer. Jour. Med. Sc., Vol. 189, No. 3, P. 436-450, March, 1935.

In this study Dr. Holman goes into exhaustive details of all the known qualities of staphylococci, under the headings of Differentiation, Cultural Methods, Modes of Infection, Antigenic Toxic Factors, Hemolysis, Leukocidin, Necrocidin, Lethal Toxin, Antitoxin Bacteriophage, and Food Poisoning. It is so complete and covers such a wide range that it cannot very well be condensed. It is also followed by an excellent list of references. It is a paper that could be studied profitably by every technician doing work in bacteriology.

MALARIA IN CEYLON, Science News, Science, Vol. 81, No. 2094, Feb. 15, 1935.

Malaria, which has swept disastrously across Ceylon, is still a mystery to the U. S. Public Health Service. Dr. L. R. Williams, of the U. S. Public Health Service, states that if the British medical men on the island, who are exceedingly competent in the malarial field, describe the present form as green, it is not likely that they are confusing it with any of the already known species.

MALARIA IN CEYLON, Foreign Letter from London in Jour. A.M.A., Vol. 104, No. 10, Mar. 9, 1935.

This leter makes no mention of this epidemic being a new type of malaria but mentions as follows: "The predominant infection is benign tertian (57 per cent), while quartan comes next (33 per cent). The malignant is rare (10 per cent)."

SYPHILIS, A VERY RAPID FLOCCULATION METHOD FOR THE DIAGNOSIS OF, a preliminary report, F. Rytz, Amer. J. Clin. Path., 5, P. 159-161, March, 1935.

This method was worked out in the clinical laboratories of the Minneapolis General Hospital, and is thus known as M. G. H. P. (Minneapolis General Hospital Precipitation).

Fifty-three hundred and fifty tests by this method were compared with Wassermann and Kahn reactions on the same serum, with the result that the method appeared to be more reliable and more sensitive than the Kahn test as performed in that laboratory.

The author claims four factors as accounting for the rapidity and sensitivity of the test which takes only 15 minutes: (1) artificial coagulation of the blood; (2) heating of the serum for three minutes only; (3) sensitization of the serum by means of ammonium sulphate; (4) use of an antigen emulsion so stable that it may be regarded as a "stock" reagent available for immediate use without further manipulation.

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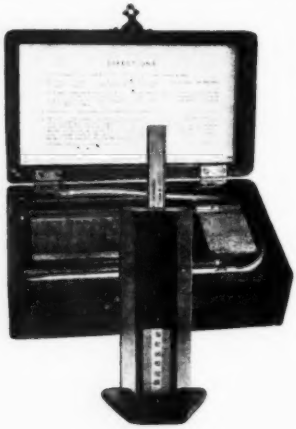

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